

# memorandum

DATE: June 30, 1997

REPLY TO  
ATTN OF:

SUBJECT: Department of Energy Historic Theme

TO: DOE Historic Preservation Contacts

At the Third DOE Cultural Resources Forum held in Nashville in April 1997, I made a commitment to provide you with additional information on the DOE Historic Theme Project. This initiative was developed to provide: (1) a coordinated DOE-wide approach to compliance with the National Historic Preservation Act (NHPA), particularly Section 106 responsibilities, and Historic Sites Act (HSA); and (2) a mechanism for enhancing DOE Outreach using non-DOE-owned properties that played an important role in the Department's history. Your participation will facilitate your site's/facility's efforts to address Section 106 requirements. By combining our efforts, DOE will be able to more comprehensively and efficiently address its compliance and outreach responsibilities.

Attached you will find the Manhattan Project Draft Theme Matrix and an accompanying User's Guide that provides some background and explanation for this approach which was discussed at the April Forum in Nashville. I have developed a proposed plan on how we might proceed with this effort:

## **Proposed Plan**

Each DOE site is being asked to:

- (1) Review and revise the Manhattan Project matrix (first stage matrix), making corrections and additions to shell list of process/activities and locations as necessary;
- (2) Complete second stage matrix by indicating with "X's" and "O's" where your properties (structures, features, etc.) might fit.
- (3) Develop a list of topics you will use to specifically classify Manhattan Project-related properties (structures, features, etc.) at your site/facility

I am hoping that the above three items will be completed by September 1, 1997. Please send your input to me, e-mail preferably.

Your list will be combined with those from other sites/facilities to prepare a comprehensive master list. Each topic in the master list will be assigned a unique code. The master list will then be sent to you for use in preparing your third stage matrix.

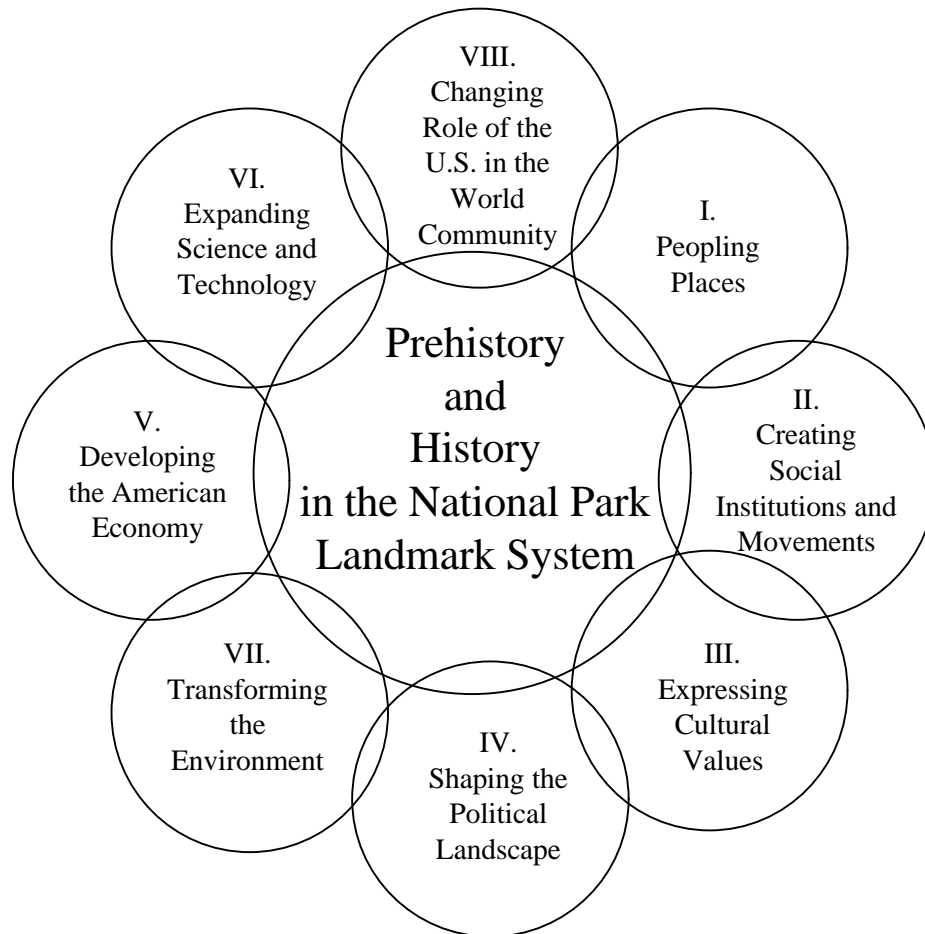
You will be requested to prepare third stage matrices when any issues arising from the second stage matrices have been resolved and the topic codes are available. This version of the matrix will break out each process/activity that has Manhattan Project-related properties (as shown on the second stage matrix) into a set of columns reflecting the topics identified in Item (3) above. Numerical data will then be entered reflecting the number of properties assigned to each topic. Instructions for completing the third stage matrices will be sent to you with the master topics list.

The success of this effort in producing a product that will be both comprehensive as well as complementing your historic preservation effort will depend upon your level of participation. Your cooperation in this effort is appreciated. Please call me if any questions at (202) 586-9581.

## DOE HISTORIC THEME PROJECT

Congress has mandated that the full diversity of American history and prehistory is expressed in the National Park Services (NPS) identification and interpretation of historic properties. The U.S. Department of Energy (DOE), through its Section 106 responsibilities under the National Historic Preservation Act (NHPA), is required to consider properties under its management that may be eligible for nomination to the National Register of Historic Places. Designation as National Historic Landmarks is also encouraged. Under its Congressional mandate, the NPS recently has published an updated thematic framework (NPS 1996) to guide the Service in working with its partners, including DOE, in the private and public sectors. A major aim of the framework is to help guide the NPS and its partners in evaluating the significance of resources for listing in the National Register or for designation as Landmarks.

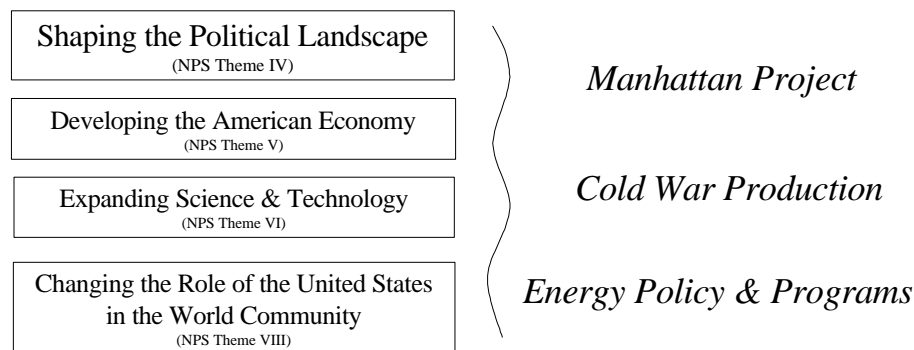
The NPS Thematic Framework is represented in the following diagram:



The eight themes shown embrace prehistory to modern times within our national borders and a broad range of human experience. Each theme represents a diverse complex of experience. The overlapping circles indicate the interrelationships that exist among the themes. The central circle symbolizes the conceptual framework underlying the themes. The Thematic Framework provides a structure for capturing the complexity and meaning of our national experience and making its past a coherent, integrated whole. The historical building blocks for the themes are people, time and place. People at all levels and across all categories are the agents of change. Time is a mechanism for organizing events and understanding processes, with an emphasis on the how and why of transformations from past to present. Place is the concrete locational context in which our history unfolds and recognizes that our national experience often has local and regional, as well as national, roots that are tied to communities at all levels.

Themes IV, V, VI and VIII (Shaping the Political Landscape, Developing the American Economy, Expanding Science and Technology, and Changing the Role of the United States in the World Community) are particularly relevant to DOE. Activities associated with the Manhattan Project, Cold War and energy policy and programs crosscut these four broad NPS themes and in themselves constitute major foci of Departmental activity that strongly shaped our history and have widespread roots at the local, regional and national levels. In concert with NPS's Congressional mandate and DOE's NHPA responsibilities, the EH Division initiated the DOE Historic Themes Project in 1996. This project has to date identified three DOE Historic Themes: the Manhattan Project Theme, the Cold War Production Theme and the Energy Policy and Programs Theme. The relationship of the DOE themes to the NPS themes is illustrated in the following diagram:

## DOE Historic Themes Project



# **DOE HISTORIC THEME PROJECT MANHATTAN PROJECT DRAFT THEME MATRIX USER'S GUIDE**

## **Background**

The DOE Historic Theme Project will be implemented in several phases, each of which addresses a specific theme. Phase I addresses the Manhattan Project Theme. Phase II deals with the Cold War Era Theme. Phase III will focus on more recent scientific and technological achievements by DOE associated with its energy policy and program areas. Employing concepts developed by the National Park Service and discussed by Harry Butowsky (DOI-NPS) at the recent Cultural Resources Forum, a process versus location matrix approach will be used for each theme to facilitate the consolidation of information about properties eligible for nomination to the National Register of Historic Places or as a National Historic Landmark. This comprehensive approach will help streamline DOE's compliance with its NHPA and Outreach responsibilities. Phase I and Phase II have already been initiated. A draft shell matrix for the Manhattan Project Theme has been developed, and a similar matrix is under development for the Cold War Era Theme.

## **Matrix Development and Submittal of Field Data**

Theme matrices will be developed in three stages. The first stage involves developing a shell matrix of processes and activities versus locations. Topics within processes/activities also may be identified. The initial shell matrices will be developed by EH.

The second stage involves site/facility manager review of each shell matrix for the accuracy and completeness of theme content. Matrix forms can be hand-annotated or electronically amended to indicate corrected or new information. Proposed changes might include: (1) correction of erroneous or incomplete information; (2) additional processes/activities and/or topics; and/or (3) inclusion of previously unrecognized sites/facilities.

Using the matrix format, site/facility managers will then identify the processes, activities and topics for which their site/facility has theme-related properties. This will result in a matrix which indicates the presence or absence of properties associated with each process, activity and topic.

The third stage of theme matrix development involves the collection of quantitative data about the numbers of properties associated with each process, activity and topic at each site/facility. The final matrix will provide quantitative measures of the types of properties present at each location associated with the matrix theme.

Second and third stage matrices may be transmitted to EH by regular mail, facsimile or e-mail (the latter two options are preferred, as they will expedite the project).

### **Manhattan Project Shell Matrix**

The initial shell matrix for the Manhattan Project Theme is enclosed. Content for the matrix is derived from *Linking Legacies* (DOE/EM-0319), U. S. Department of Energy, Office of Environmental Management, January 1997, the summary of historic information that is contained on the poster reprinted on the last page of that document and other sources. Supplemental sources of information about Manhattan Project activities, processes and sites owned by DOE or used by DOE-funded projects are provided in the attached bibliography.

### **Matrix Description**

The enclosed Manhattan Project Draft Theme Matrix consists of the shell matrix listing of processes and activities across the top and locations (sites/facilities) down the side. Processes and activities may be topically divided, depending on the nature of the applicable properties present at a site/facility. Matrix cells opposite a location should be marked with either an "X" or an "O" to indicate present or absent. Thus, an "X" would indicate that the site/facility has one or more properties at which the indicated process/activity/topic occurred. An "O" would indicate that the site/facility has never had properties at which the indicated process/activity/topic occurred.

### **Topics**

Shell matrices provide an opportunity to develop topics that help characterize processes/activities and provide context for historic properties. Site/Facility managers are encouraged to identify topics and classify their properties accordingly. These topics should also be used to facilitate site-specific NHPA Section 106 compliance actions regarding nominations to the National Register of Historic Places and National Historic Landmarks.

Examples of topics proposed at the 1997 DOE Cultural Resources Forum that could be applied to the Manhattan Project include:

- A. Prehistoric and Historic Settlement (before the Manhattan Project).
- B. Land Acquisition (for Manhattan Project activities).
- C. Famous People (associated with the Manhattan Project)
- D. Decision Making.
- E. Technological Breakthroughs.
- F. Work Force Services and Housing
- G. Training the Work Force
- H. Security.

This list is not exhaustive, and site/facility managers are encouraged to use these and add other topics as appropriate. The topics should be identified and transmitted to EH for compilation with lists from other sites/facilities. A master list of topics will be prepared by EH and shared with site/facility managers. The master list of topics will facilitate the uniform entry of data in third stage matrices concerning the number of properties present at a site/facility that are associated with each topic. In this manner, topics can be tied to counts of individual structures or structural groups (e.g., buildings, vaults, bunkers, etc.) and features (e.g., berms, craters, lagoons, pits, yards, etc.). This approach will provide a valuable tracking tool at the regional and national level for managing properties that are eligible for inclusion in the National Register or Landmarks Programs.

## MANHATTAN PROJECT CULTURAL RESOURCES WORKING BIBLIOGRAPHY

### BOOKS - PERIODICALS - TECHNICAL REPORTS

American Nuclear Society, *Controlled Nuclear Chain Reaction: The First 50 Years*, American Nuclear Society, LaGrange Park Illinois, 1992.

Antonas, N. J., J. W. Darby, and C. R. Hickey, "Remedial Action at the National Guard Armory and the University of Chicago in Chicago, Illinois," preprint, private communication, from Bechtel National Inc. Oak Ridge, TN, undated.

Badash, Lawrence, Joseph O. Hirschfelder, and Herbert P. Broida, *Reminiscences of Los Alamos 1943 - 1945*, Volume 5 of Studies in the History of Modern Science, eds. Robert S. Cohen, Erwin N. Hiebert, and Everett I. Mendelsohn, D. Reidel Publishing Company, Boston, 1980.

Bennis, William and Patricia Ward Biederman, *Organizing Genius*, Addison-Wesley, Reading Massachusetts, 1997.

Borman, Stu, "Chemists Reminisce on 50th Anniversary of the Atomic Bomb," *Chemical and Engineering News*, pp. 53 - 63, July 17 1995.

Bradbury, Norris, "Los Alamos - The First 25 Years," in Badash, Lawrence, Joseph O. Hirschfelder, and Herbert P. Broida, *Reminiscences of Los Alamos 1943 - 1945*, Volume 5 of Studies in the History of Modern Science, eds. Robert S. Cohen, Erwin N. Hiebert, and Everett I. Mendelsohn, D. Reidel Publishing Company, Boston, 1980.

Brinkley, David, *Washington Goes to War*, Alfred A. Knopf, New York, 1988.

Brode, Bernice, "Tales of Los Alamos," in Badash, Lawrence, Joseph O. Hirschfelder, and Herbert P. Broida, *Reminiscences of Los Alamos 1943 - 1945*, Volume 5 of Studies in the History of Modern Science, eds. Robert S. Cohen, Erwin N. Hiebert, and Everett I. Mendelsohn, D. Reidel Publishing Company, Boston, 1980.

Brown, Anthony Cave and Charles B. MacDonald. *The Secret History of the Atomic Bomb*. New York: The Dial Press/James Wade, 1977.

Christman, Al, "The Atomic Bomb: Making it Happen," *American Heritage of Invention and Technology*, Vol. 11, No. 1, pp. 22-35 (Summer 1995).

Clark, Ronald W., *The Birth of the Bomb*, Phoenix House Ltd. London, 1961.

Cochran, Thomas B., William M. Arkin, Robert S. Norris, and Milton M. Hoenig, *Nuclear Weapons Databook, Vol II - U.S. Nuclear Warhead Production*, Ballinger Publishing Company, Cambridge, MA, 1987.



Cochran, Thomas B., William M. Arkin, Robert S. Norris, and Milton M. Hoenig, *Nuclear Weapons Databook, Vol III - U.S. Nuclear Warhead Facility Profiles*, Ballinger Publishing Company, Cambridge, MA, 1987.

Compton, Arthur Holly, *Atomic Quest*, Oxford University Press, New York, 1956.

Cooper, Dan, "The Atomic Bomb: Making it Possible," *American Heritage of Invention and Technology*, Vol. 11, No. 1, pp. 10-21 (Summer 1995).

Crane, P.W. and W.O. Switzer, "Technical Department - Procurement and Training of Non-Exempt Personnel," a memorandum for the file from the E.I. DuPont De Nemours & Company archives at the Hagley Museum and Library in Wilmington, Delaware, September 5 1945.

D'Antonio, Michael, *Atomic Harvest: Hanford and the Lethal Toll of America's Nuclear Arsenal*, Crown Publishers Inc., New York, 1993.

Davis, Nuel P., *Lawrence and Oppenheimer* (New York: Simon and Schuster, 1968).

Del Tredici, Robert, *At Work in the Fields of the Bomb*, Harper and Row, New York, 1987.

Farmelo, Graham, "The Day Chicago Went Critical," *New Scientist*, pp. 26 - 29 1992.

Fermi, Laura, *Atoms in the Family*, Chicago: University of Chicago Press, 1954.

Fermi, Laura, "The Fermi's Path to Los Alamos," in Badash, Lawrence, Joseph O. Hirschfelder, and Herbert P. Broida, *Reminiscences of Los Alamos 1943 - 1945*, Volume 5 of Studies in the History of Modern Science, eds. Robert S. Cohen, Erwin N. Hiebert, and Everett I. Mendelsohn, D. Reidel Publishing Company, Boston, 1980.

Fineman, Olga Giachetti, "A Look Back in Time," presented at the Argonne National Laboratory Second Women's Technical Symposium, Argonne National Laboratory, April 28 1996.

Fisher, Phyllis K., *The Los Alamos Experience*, Japan Publications Inc., Tokyo, 1985.

Freeman, Leslie J. *Nuclear Witnesses: Insiders Speak Out*. New York: W. W. Norton & Company, 1981.

Furman, Necah Stewart, *Sandia National Laboratories: The Postwar Decade*. Albuquerque: University of New Mexico Press, 1990.

Gerber, M. S., *The Hanford Site: An Anthology of Early Histories*, WHC-MR-0435, prepared for the U. S. Department of Energy Office of Environmental Restoration and Waste Management, Westinghouse Hanford Company, P.O. Box 170, Richland Washington 99352, October 1993.

Goldberg, Stanley. Smithsonian Videohistory Program series on the Manhattan Project. The Videohistory Archives, The Smithsonian Institution, Washington DC, 1992.

Gosling, F. G., *The Manhattan Project: Science in the Second World War*, U.S. Department of Energy, Office of Administration and Human Resources Management, History Division, Washington DC, August 1990.

Gosling, F. G., *The Manhattan Project: Making the Atomic Bomb*, U.S. Department of Energy, History Division, Executive Secretariat, Human Resources and Administration, Washington DC, September 1994.

Graf, William L., *Plutonium and the Rio Grande*, Oxford University Press, New York, 1994.

Greenbaum, Leonard, *A Special Interest: The Atomic Energy Commission, Argonne National Laboratory, and the Midwestern Universities*, The University of Michigan Press, Ann Arbor, 1971.

Groueff, Stephanie, *Manhattan Project: The Untold Story of the Making of the Atomic Bomb*, Little, Brown, and Company, Boston, 1967.

Groves, Leslie R., *Now It Can Be Told: The Story of the Manhattan Project*, Da Capo Press, Inc., New York, New York, 1962.

Hacker, Barton C., *The Dragon's Tail: Radiation Safety in the Manhattan Project, 1942-1946*, University of California Press, Berkeley, 1987.

Hafemeister, David, editor, *Physics and Nuclear Arms Today*, American Institute of Physics, New York, 1991.

Hawkins, David, *Manhattan District History, Project Y, The Los Alamos Project: Volume I. Inception Until August 1946*, LAMS-2532, Los Alamos Scientific Laboratory, Los Alamos New Mexico, 1961.

Hawkins, David, *Project Y: The Los Alamos Story. Part I: Toward Trinity*, Volume II of The History of Modern Physics, 1800-1950, Tomash Publishers, Los Angeles, 1983.

Herzenberg, Caroline L. and Ruth H. Howes, "Women of the Manhattan Project," *Technology Review* **96**, 32 - 40, 1993.

Hewlett, Richard G. and Oscar E. Anderson Jr., *The New World 1939-1946*, Volume I of *A History of the United States Atomic Energy Commission*, Pennsylvania State University Press, University Park, PA, 1962.

Hirschfelder, Joseph O., "The Scientific and Technological Miracle at Los Alamos, in Badash, Lawrence, Joseph O. Hirschfelder, and Herbert P. Broida, *Reminiscences of Los Alamos 1943 - 1945*, Volume 5 of *Studies in the History of Modern Science*, eds. Robert S. Cohen, Erwin N.

Hiebert, and Everett I. Mendelsohn, D. Reidel Publishing Company, Boston, 1980

Hoddeson, Lillian, Paul W. Henriksen, Roger A. Meade, and Catherine Westfall, *Critical Assembly: A Technical History of Los Alamos During the Oppenheimer Years, 1943 - 1945*, Cambridge University Press, 1993.

Howes, Ruth H.. "Leona Woods Marshall Libby (1919 - 1986)". *Women in Physics and Chemistry: A Bibliographic Sourcebook*. Louise S. Grinstein, Rose K. Rose, and Miriam H. Rafailovitch eds. Greenwood Press (1993).

Howes, Ruth H. and Caroline L. Herzenberg, "Women in Weapons Development: The Manhattan Project," in *Women and the Use of Military Force* (eds. Ruth H. Howes and Michael R. Stevenson), Lynne Rienner Publishers, Boulder and London, 1993.

Howes, Ruth H. and Caroline L. Herzenberg, *Their Day in the Sun: The Women Scientists of the Manhattan Project*, Temple University Press, Philadelphia (in editing).

Jette, Eleanor, *Inside Box 1663* (Los Alamos: Los Alamos Historical Society, 1977).

Johnson, Charles W. and Charles O. Jackson, *City Behind a Fence: Oak Ridge, Tennessee, 1942-1946*, The University of Tennessee Press, Knoxville, 1981.

Jones, Vincent, *Manhattan: The Army and the Atomic Bomb* (United States Army in World War II, Special Studies), Center of Military History, United States Army, Washington, DC, 1985.

Jungk, Robert, *Brighter than a Thousand Suns: A Personal History of the Atomic Scientists* (New York: Harcourt Brace and Company, 1958).

Karren, Susan, "Atomic Weapons in World War II: Materials in the National Archives," *American Institute of Physics History Newsletter*, **22**, No. 1, pp. 1 - 4 (April 1990).

Kathren, Ronald L., Jerry B. Gough, and Gary T. Benefiel, eds., *The Plutonium Story: The Journals of Professor Glenn T. Seaborg, 1939-1946*, Battelle Press, Columbus, 1994.

Lamont, Lansing. *Day of Trinity*. New York: Athaneum, 1965.

Lanouette, William, with Bela Silard, *Genius in the Shadows: A Biography of Leo Szilard, the Man Behind the Bomb*, Charles Scribner's Sons, New York NY, 1992.

Laurence, William L., *Dawn Over Zero: The Story of the Atomic Bomb*, Alfred A. Knopf, New York, 1947.

Laurence, William L., *Men and Atoms*, Simon and Schuster, New York, 1959.

Lawren, William, *The General and the Bomb: A Biography of General Leslie R. Groves, Director of the Manhattan Project*, Dodd Mead and Company, New York, 1988.

Leclercq, Jacques. *The Nuclear Age*.

Libby, Leona Marshall. *The Uranium People*. New York: Crane Russak and Charles Scribner's Sons, 1979.

Loeb, Paul, *Nuclear Culture: Living and Working in the World's Largest Atomic Complex*, New Society Publishers, Philadelphia Pennsylvania, 1986.

Los Alamos National Laboratory, "Polonium Human-Injection Experiments," *Los Alamos Science*, No. 23, Los Alamos National Laboratory, Los Alamos, New Mexico, 1995.

Los Alamos National Laboratory, "Working with Plutonium at Los Alamos: Early Years - 1944 to 1946 in D Building," *Los Alamos Science*, No. 23, Los Alamos National Laboratory, Los Alamos, New Mexico, 1995.

Los Alamos Scientific Laboratory, *Los Alamos 1943-1945: The Beginning of an Era*, LASL-79-78, Los Alamos, New Mexico, undated.

Los Alamos Scientific Laboratory, *The First 20 Years at Los Alamos: January 1943 - January 1963*, LASL News, January 1, 1963, Los Alamos Scientific Laboratory, Los Alamos, New Mexico.

Lyon, Fern, and Jacob Evans, editors, *Los Alamos: The First Forty Years* (Los Alamos: Los Alamos Historical Society, 1984).

Manley, John H., "A New Laboratory is Born," Badash, Lawrence, Joseph O. Hirschfelder, and Herbert P. Broida, *Reminiscences of Los Alamos 1943 - 1945*, Volume 5 of Studies in the History of Modern Science, eds. Robert S. Cohen, Erwin N. Hiebert, and Everett I. Mendelsohn, D. Reidel Publishing Company, Boston, 1980.

Manley, Kathleen E. B., "Women of Los Alamos During World War II: Some of Their Views," *New Mexico Historical Review*, pp. 251 - 266, April 1990.

Martin, Murray J., Norwood B. Gove, Ruth M. Gove, and Agda Artna-Cohen, "Katharine Way (1903 - )," in *Women in Physics and Chemistry -- Biobibliographic Sourcebook*, Louise S. Grinstein, Rose K. Rose, and Miriam H. Rafailovich (eds.), Greenwood Press (1993).

McDaniel, B. D., Leo S. Lavatelli, and Elizabeth Graves, "Modulation and Other Techniques Used with Ion Accelerators," in *Miscellaneous Physical and Chemical Techniques of the Los Alamos Project: Experimental Techniques*, edited by Alvin C. Graves and Darol K. Froman, McGraw-Hill Book Company, Inc., New York, 1952.

McKay, Alwyn, *The Making of the Atomic Age*, Oxford University Press, Oxford, 1984.

McKibben, Dorothy, "I'll Take Manhattan," *Atom*, Vol. 17, pp. 7-9.

McNulty, William, "World's Most Famous Scientists, En Route to Los Alamos Project, Go Through Ancient City Office," *Santa Fe New Mexican*, May 19 1946.

Metropolis, N. and E. C. Nelson. "Early Computing at Los Alamos." *Annals of the History of Computing*, 4, No. 4, pp. 348 - 357, October 1982.

*Monsanto Magazine*, February 1946.

Nichols, Kenneth D., *The Road to Trinity*, William Morrow and Co., New York, New York, 1987.

Nier, Alfred, "Some Reminiscences of Mass Spectrometry and the Manhattan Project," *Journal of Chemical Education* Vol. 66, pp. 385-388, 1989.

Nordheim, Lothar W., "Old Times and New Horizons," in *Oak Ridge National Laboratory Annual Report 1970-71*, Oak Ridge National Laboratory, Oak Ridge Tennessee, 1971; also in *Oak Ridge National Laboratory Review*, fall 1976.

Noyes, W. A., Jr., editor, *Chemistry: A History of the Chemistry Components of the National Defense Research Committee, 1940-1946*, Little Brown and Company, Boston, 1948.

*Nuclear History*, the Newsletter of the Nuclear History Program, Nuclear History Program, College Park MD.

Oak Ridge National Laboratory, *Oak Ridge National Laboratory Review*, Vol. 25, Numbers 3 and 4, 1993.

Parker, H. M. Various memoranda for file contained in the DuPont archives at the Hagley Museum and Library in Wilmington Delaware, 1945.

Rapoport, Roger. *The Great American Bomb Machine*. New York: Ballantine Books, 1971.

Rhodes, Richard. *The Making of the Atomic Bomb*. New York: Simon and Schuster, 1986.

Rhodes, Richard, "Introduction" in *The Los Alamos Primer* by Robert Serber, University of California Press, Berkeley, 1992.

Robinson, George O., *The Oak Ridge Story: The Saga of a People Who Share in History*, Southern Publishers, Inc., Kingsport, Tennessee, 1950.

Rodden, Clement J., "Before NBL," *Journal of the Institute of Nuclear Materials Management*, Volume 18, Number 1, pp. 14 - 15, November 1989.

Roensch, Elearno Stone, *Life Within Limits*, The Los Alamos Historical Society, Los Alamos New Mexico, 1993.

Rona, Elizabeth, *How It Came About: Radioactivity, Nuclear Physics, Atomic Energy*, Oak Ridge Associated Universities, Oak Ridge Tennessee, 1978.

Rosenthal, Debra, *At the Heart of the Bomb: The Dangerous Allure of Weapons Work*, Addison-Wesley, Reading MA, 1990.

Sacher, George A., "A Sentimental History of Site B," *Argonne News*, Vol. 4, No. 5, 1952.

Sachs, Robert G., "Maria Goeppert Mayer," *National Academy of Sciences of the United States of America Biographical Memoirs*, Vol 50, pp. 310 -327, National Academy of Sciences, Washington DC 1979.

Sanger, S. L. with Robert W. Mull, *Hanford and the Bomb: An Oral History of World War II*, Living History Press, Seattle, 1989.

Sapirie, Samuel R., *A Secret Mission and Other Disclosures: Memoirs of the Manager, Oak Ridge Operations, U.S. Atomic Energy Commission*, Oak Ridge Community Foundation, Oak Ridge Tennessee, 1992.

Schwarz, Frederic C., "The Half-life of History," *American Heritage of Invention and Technology*, Vol. 11, No. 1, pp. 6 - 7 (Summer 1995).

Seaborg, Glenn T., *Nuclear Milestones - Volume One: Builders and Discoverers*, U. S. Atomic Energy Commission, Washington DC, May 1971.

Seaborg, Glenn T., *History of Met Lab Section C-1: April 1942 to April 1943*, PUB 112, Lawrence Berkeley Laboratory, University of California, Berkeley, February 1977.

Seaborg, Glenn T., *History of Met Lab Section C-1: May 1943 to April 1944*, PUB 112, Vol. II, Lawrence Berkeley Laboratory, University of California, Berkeley, May 1978.

Seaborg, Glenn T., *History of Met Lab Section C-1: May 1944 to April 1945*, PUB 112, Vol III, Lawrence Berkeley Laboratory, University of California, Berkeley, May 1979.

Seaborg, Glenn T., *History of Met Lab Section C-1: May 1945 to May 1946*, PUB 112, Vol IV, Lawrence Berkeley Laboratory, University of California, Berkeley, May 1979.

Seaborg, Glenn T., "Silver, Copper, and Honest-to-God Copper," *Journal of the Institute of Nuclear Materials Management*, Vol. 18, No. 1, 1989.

Serber, Robert, "Theoretical Studies at Berkeley," in *Behind Tall Fences*, Los Alamos Historical Society, Los Alamos, New Mexico, 1996.

Smith, Alice Kimball, *A Peril and a Hope: The Scientists Movement in America 1945-47*, Chicago: The University of Chicago Press, 1965.

Smith, Alice Kimball and Charles Weiner, editors, *Robert Oppenheimer: Letters and Recollections*, Harvard University Press, Cambridge Massachusetts 1980.

Smyser, Dick, *Oak Ridge 1942-1992: A Commemorative Portrait*, Oak Ridge Community Foundation Inc., Oak Ridge Tennessee, 1992.

Smyth, Henry DeWolf, *Atomic Energy for Military Purposes: The Official Report on the Development of the Atomic Bomb Under the Auspices of the U.S. Government 1940 - 1945*, Princeton University Press, Princeton, New Jersey, 1946.

Stoff, Michael B., Jonathan F. Fanton, and William R. Hal, *The Manhattan Project: A Documentary Introduction to the Atomic Age*. (Philadelphia: Temple University Press, 1992?).

Sylves, Richard T. *The Nuclear Oracles: A Political History of the General Advisory Committee of the Atomic Energy Commission, 1947 - 1977*. Ames, IA: Iowa State University Press, 1987. [This has the best material on Jane Hall, including pictures; also Ruth Patrick, Evans Hayward].

Szasz, Ferenc Morton, *The Day the Sun Rose Twice: The Story of the Trinity Site Nuclear Explosion July 16, 1945*, University of New Mexico Press, Albuquerque, 1984.

Technology Review staff, "The Legacies of World War II: A Roundtable Discussion," *Technology Review*, Vol. 98, No. 4, May/June 1995.

Tennenbaum, Jonathan, *Die weibliche Technik*, Dr. Boettiger Verlags - GmbH, Wiesbaden, Germany, 1995.

Truslow, Edith C., and Ralph Carlisle Smith, *Manhattan District History: Project Y: The Los Alamos Project Volume II, August 1945 through December 1946*, LAMS-2532, Los Alamos Scientific Laboratory, Los Alamos New Mexico, December 1 1961.

Truslow, Edith C., *Manhattan District History: Nonscientific Aspects of Los Alamos Project Y 1942-1946*, edited by Kasha V. Thayer, The Los Alamos Historical Society, Los Alamos New Mexico, 1991.

Truslow, Edith C. and Ralph Carlisle Smith, *Project Y: The Los Alamos Story. Part II, Beyond Trinity*, Volume II of The History of Modern Physics, 1800-1950, Tomash Publishers, Los Angeles, 1983.

Ulam, S. M., *Adventures of a Mathematician*, Charles Scribner's Sons, New York, 1976.

U. S. Department of Energy. 40th Anniversary: *The First Reactor*. Washington, DC: U. S. Department of Energy, 1982.

U.S. Department of Energy/Martin Marietta Energy Systems Inc., *Oak Ridge National Laboratory Review*, Chapter 1, "Wartime Laboratory", Vol. 25, Nos. 3 and 4, 1992.

U.S. Department of Energy, *Plutonium Working Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Plutonium Storage*, Volume i: Summary, DOE/EH-0415, U.S. Department of Energy, November 1994.

U.S. Department of Energy, Office of Fissile Materials Disposition, *Storage and Disposition of Weapons-Useable Fissile Materials: Draft Programmatic Environmental Impact Statement*, Volume I, DOE/EIS-0229-D, U.S. Department of Energy, Washington DC, February 1996.

U.S. Department of Energy, Office of Environmental Management, *Linking Legacies*, DOE/EM-0319, U.S. Department of Energy, Washington DC, January 1997.

Van Arsdol, Ted, "Radiation was Novel, Weird Job Experience," part of a series of articles on "The City that Shook the World" in the *Columbia Basin News*, Richland WA, 1958.

Van Arsdol, Ted, "Hanford: The Big Secret," part of a series of articles on "The City that Shook the World" in the *Columbia Basin News*, Richland WA, 1958.

Weart, Spencer, *Scientists in Power*, Cambridge, MA: Harvard University Press, 1979.

Weart, Spencer, *Nuclear Fear: A History of Images*, Cambridge, MA: Harvard University Press, 1988.

Weber, Robert L., *Pioneers of Science: Nobel Prize Winners in Physics*, Second Edition, Adam Hilger, Bristol and Philadelphia.

Wilson, Jane, editor, *All in Our Time*, Bulletin of the Atomic Scientists, Chicago, 1974.

Wilson, Jane S. and Charlotte Serber, eds.. *Standing By and Making Do: Women of Wartime Los Alamos*. Los Alamos, NM: The Los Alamos Historical Society, 1988.

Wyden, Peter, *Day One: Before Hiroshima and After*, Simon and Schuster, New York, 1984.

Zirkle, Raymond E. et al., "The Plutonium Project," *Radiology* Vol. 49, No. 3, 1947.

## **AUDIOTAPES AND VIDEOTAPES**

Reminiscences from the Metallurgical Laboratory, provided by various sources.

Sacher, Dorothea, Downers Grove Illinois, provision of audiotape "Early Met Lab Days" recorded May 11 1965.

Argonne National Laboratory, Second Technical Women's Symposium: Women at Argonne, 1946-1996, Part 4 of videotape.



## **ON-LINE SOURCES**

Home pages of the DOE laboratories and facilities on the World Wide Web.

U.S. Department of Energy, Office of Human Radiation Experiments web site,  
<http://www.ohre.doe.gov>.

DOE NATIONAL HISTORIC THEMES — DRAFT MANHATTAN PROJECT THEME MATRIX

SITE/FACILITY	LOCATION	A C T I V I T Y — P R O C E S S												TOTAL Str. Fea.	NAT'L REG. Eligible Str. Fea .			
		Admin & Mgmt	Nuclear Physics Research	Uranium		Reactor		Plutonium		Isotope Sep. Methods		Radiobiology				Weapons		
				Procurement & Processing	Chemistry & Metallurgy	Fuel Fabrication	R & D	Chemistry & Metallurgy	Chemical Separations	Production Reactor Operations	R & D	Operations	Health & Medical Physics			Research & Design	Bomb Component Fabrication	Device & Weapons Testing
A LIST OF LOCATIONS AT WHICH ACTIVITIES ASSOCIATED WITH THE MAHATTAN PROJECT TOOK PLACE																		
This list of locations is intended to help identify buildings and places where historically significant events of the Manhattan project took place. It is limited to locations in the United States.																		
Some mining and other operations were conducted in Canada and Africa. The list is incomplete. Additional entries should be made for those locations not already included.																		
MAJOR SITES																		
University of Chicago Metallurgical Laboratory	Chicago	IL																
Los Alamos Laboratory	Los Alamos	NM																
Clinton Engineer Works K-25 Gaseous Diffusion Plant	Oak Ridge	TN																
Clinton Engineer Works S-50 Thermal Diffusion Plant	Oak Ridge	TN																
Clinton Engineer Works X-10 Semiworks Reactor/ORNL	Oak Ridge	TN																
Clinton Engineer Works Y-12 Electromagnetic Separation Plant	Oak Ridge	TN																
Hanford Engineer Works (incl. B, D and F Reactors)	Richland	WA																
Hanford Engineer Works (incl. B, T and U Reprocessing Plants)	Richland	WA																
UNIVERSITIES																		
California Institute of Technology	Pasadena	CA																
California Institute of Technology	Inyokern	CA																
Stanford University	Stanford	CA																
University of California	Berkeley	CA																
University of California	Davis	CA																
University of California Radiation Laboratory	Berkeley	CA																
Trinity College	Hartford	CT																
Yale University	New Haven	CT																
Iowa State College - Ames Project	Ames	IA																
University of Chicago	Chicago	IL																
University of Chicago Metallurgical Laboratory	Chicago	IL																
Purdue University	West Lafayette	IN																
Massachusetts Institute of Technology	Cambridge	MA																
Johns Hopkins University	Baltimore	MD																
University of Minnesota	Minneapolis	MN																
Washington University	St. Louis	MO																
Princeton University	Princeton	NJ																
Columbia University	New York	NY																
Cornell University	Ithaca	NY																

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				Procurement & Processing	Chemistry & Metallurgy	Fuel Fabrication	R & D	Chemistry & Metallurgy	Chemical Separations	Production Reactor Operations	R & D		Operations	Health & Medical Physics			Research & Design	Bomb Component Fabrication	Device & Weapons Testing
University of Rochester	Rochester																		
Brown University	Providence																		
University of Virginia	Charlottesville																		
University of Washington	Seattle																		
INDUSTRIAL LOCATIONS																			
Pacific Aviation Co.	Los Angeles																		
(a uranium mining & milling corp.)	Rifle																		
(a uranium mining & milling corp.)	Slick Rock																		
Metals Reserve Corp.	Durango																		
United States Vanadium Corp. - URAVAN	Nauritia																		
Vanadium Corp. of America	Naturita																		
Houdaille-Hershey Co.	Decatur																		
Skidmore, Owings & Merrill	Chicago																		
Metal Hydrides Inc. - Ventron Site	Beverly																		
Stone and Webster Engineering Corp.	Boston																		
Chrysler Corp.	Detroit																		
Mallinckrodt Chemical Works	St. Louis																		
Monsanto Chemical Corp.	St. Louis																		
Dupont Corporation	Wilmington																		
J.A. Jones Construction	Charlotte																		
Bart Engineering	Bellville																		
Dupont Corporation	Deepwater																		
Kellogg Corporation (M.W. Kellogg Co.)/Pierpont	Jersey City																		
Standard Oil Development Co.																			
Union Mines Development Corp.	Murray Hill																		
Westinghouse Electric & Manufacturing Co.	Bloomfield Long Island City																		
American Chicel	NY																		
Ashland Oil Sites	Tonawanda																		
Bell Telephone Laboratories	NY																		
Canadian Radium and Uranium Corp.	NY																		
Electro Metallurgical Co.	NY																		
General Electric Co.	NY																		
Harshaw Chemical Co.	NY																		
Hooker Electrochemical Co.	NY																		
Linde Air Products Corp.	NY																		

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SITE/FACILITY	LOCATION	A B C D E F G H I J K L M N O P Q R S T U V W X Y Z												NAT'L REG.											
		Admin & Mgmt	Nuclear Physics Research	A		B		C		D		E		F		G		H		I		J		TOTAL Str.	Fea.
				Topics	Topics	Procurement & Processing	Chemistry & Metallurgy	Fuel Fabrication	R & D	Chemistry & Metallurgy	Plutonium	Production Reactor Operations	Isotope Sep. Methods	Radiobiology	Research & Design	Bomb Component Fabrication	Device & Weapons Testing								
Linde Research Laboratory	Tonowanda																								
Tennessee Eastman Corp.	Rochester																								
Union Carbide and Carbon Corp. - Carbide and Carbon Chemicals Co.	New York																								
B & T Metals	Columbus																								
Baker Brothers	Toledo																								
Brush Beryllium Co.	Lorain																								
Harshaw Chemical Co.	Cleveland																								
Herring-Hall-Marvin Safe Co.	Hamilton																								
H.J. Ferguson	Cleveland																								
Monsanto Chemical Corp.	Dayton																								
Victoreen Instrument Co.	Cleveland																								
C.H. Schnoor	Springdale																								
Westinghouse Electric & Manufacturing Co.	Pittsburgh																								
Monsanto Chemical Corp.	Oak Ridge																								
Tennessee Eastman Corp.	Oak Ridge																								
Tennessee Eastman Corp.	Kingsport																								
Union Carbide and Carbon Corp. - Carbide and Carbon Chemicals Co.	Oak Ridge																								
Vanadium Corp. of America	Monticello																								
Alcoa Aluminum Corp.																									
J.A. Jones Construction	Richland																								
Allis-Chalmers Manufacturing Co.	Milwaukee																								
American Chain and Cable																									
American Cyanimid																									
Beryllium Corp. of America or precursor)																									
Copperweld Steel																									
Eldorado Mining and Refining Co.																									
Expert Tool and Die Co.																									
General Chemical																									
Kenetic Chemicals																									
McKinney Tool and Die																									
National Carbon Company																									
Penn Salt																									
Quality Hardware																									
Revere Copper and Brass																									
Speer Carbon Company																									
Vitro Manufacturing Co.																									
Westinghouse Electric & Manufacturing Co.																									
William E. Pratt Mfg.																									
Wolverine Tube																									

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		Admin & Mgmt	Nuclear Physics Research	Uranium		Reactor		Plutonium		Isotope Sep. Methods		Radiobiology	Weapons		TOTAL Sr.	Fea.			
				Procurement & Processing	Chemistry & Metallurgy	Fuel Fabrication	R & D	Chemistry & Metallurgy	Chemical Separations	Production Reactor Operations	R & D		Operations	Health & Medical Physics			Research & Design	Bomb Component Fabrication	Device & Weapons Testing
GOVERNMENT LOCATIONS																			
Alabama Ordnance Works	AL																		
China Lake Naval Ordnance Testing Station	CA																		
Los Angeles Production Office	CA																		
Muroc Base	CA																		
Naval Auxiliary Air Station	CA																		
Oxnard Field	CA																		
Salton Sea Test Base	CA																		
Sandy Beach Naval Auxiliary Air Facility	CA																		
U.S. Corps of Engineers - Manhattan Distric Office	CA																		
Grand Junction Projects Office	CO																		
National Bureau of Standards	DC																		
National Defense Research Committee	DC																		
Naval Gun Factory	DC																		
Naval Research Laboratory	DC																		
Office of Scientific Research & Development	DC																		
U.S. Corps of Engineers - Manhattan District Office (Mahatian Project HQ)	DC																		
U.S. Corps of Engineers - Manhattan District Office	IL																		
Site A/Plot M (Argonne Laboratory)	IL																		
Wabash River Ordnance Works	IN																		
U.S. Corps of Engineers - Manhattan District Office	MA																		
Middlesex Sampling Plant	NJ																		
Alamogordo Army Air Field	NM																		
Albuquerque District Corps of Engineers	NM																		
Los Lunas Test Range	NM																		
Sandia Laboratory	NM																		
Trinity Test Site	NM																		
White Sands Missile Range	NM																		
U.S. Corps of Engineers - Manhattan District Office	NY																		
Philadelphia Navy Yard	PA																		
Naval Ammunition Depot	OK																		
U.S. Bureau of Mines	PA																		
Wendover Field Army Air Base - Project Alberta	UT																		

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		Admin & Mgmt Topics	Nuclear Physics Research Topics	Uranium		Reactor		Plutonium		Isotope Sep. Methods		Radiobiology	Weapons		TOTAL Sr.	Fea.			
				Procurement & Processing Topics	Chemistry & Metallurgy Topics	Fuel Fabrication Topics	R & D Topics	Chemistry & Metallurgy Topics	Chemical Separations Topics	Production Reactor Operations Topics	R & D Topics		Operations Topics	Health & Medical Physics Topics			Research & Design Topics	Bomb Component Fabrication Topics	Device & Weapons Testing Topics
Morgantown Ordnance Works	Morgantown WV																		
Yorktown Naval Mine Depot	Yorktown VA																		
Dahlgren Naval Proving Ground																			
Naval Ordnance Plant																			
Agriculture - Fixed Nitrogen Research Lab																			
OTHER LOCATIONS																			
Project Camel	Inyokern CA																		
University of California Hospital	San Francisco CA																		
Carnegie Institution of Washington	Washington DC																		
National Academy of Sciences	Washington DC																		
National Cancer Institute	Washington DC																		
Franklin Institute	Newark DE																		
Ames Laboratory	Ames IA																		
Billings Hospital	Chicago IL																		
Chicago Tumor Institute	Chicago IL																		
Michael Reese Hospital	Chicago IL																		
Museum of Science and Industry	Chicago IL																		
National Guard Armory	Chicago IL																		
Middlesex Sampling Plant	Middlesex NJ																		
Bayou Canyon	Los Alamos NM																		
Chupadera Mesa	Missile Range NM																		
Omega Site	Los Alamos NM																		
Memorial Hospital	New York NY																		
SAM Laboratories	New York NY																		
Albany Research Center	Albany OR																		
Aliquippa Forge	Aliquippa PA																		
Elza Gate	Oak Ridge TN																		
TOTAL Structures/Features																			